PATENT APPLICATION

Storage Management Computer

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STORAGE MANAGEMENT COMPUTER

BACKGROUND OF THE INVENTION

The present invention relates to a method of managing a storage system included in an information processing system, and more particularly to the method

5 of managing a system in a computer system having a plurality of computers interconnected with a plurality of storage apparatuses through physical mediums such as Fibre Channel and Ethernet.

In general, a computer system often used in

10 an office, an enterprise or the like includes a plurality of host computers (each of which is referred simply to as a host) interconnected through a network like Ethernet. This network is called LAN (Local Area Network). The LAN may be connected with another

15 network so that the LAN be built in a large-scale system, ranging from a regional system to the worldwide system as the largest area system.

With recent advent of the Fibre Channel that realizes a faster data transfer, the concept of a SAN

20 (Storage Area Network) appears which includes a plurality of hosts connected with a plurality of storages through one physical communication line. If the SAN includes a plurality of hosts and storages like disk apparatuses interconnected therewith, all the

25 hosts connected in the SAN may make access to one disk

apparatus. Conventionally, one host can be connected

with only one storage, while the SAN allows a plurality

of hosts to make access to any storage so that the

hosts can easily share any storage apparatus. This,

5 however, leads to the complicated connections between

the hosts and the storages.

In a case that a simply configured network

includes a small number of hosts and storages, each

user of the connected apparatuses can easily manage the

10 apparatuses, so that a significant problem may hardly

take place. That is, if a user replaces an existing

apparatus with a new one and installs software into the

apparatus, a problem may hardly take place. Even if a

certain problem takes place, the user may relatively

15 easily diagnose what kind of problem took place, and

the problem does not have an adverse effect on so wide

a range of the network.

On the other hand, in a large-scaled

complicated network or a large-scaled LAN having LANs

20 interconnected therewith, the adverse effect given by a

possible problem ripples through the network and the

search, and the diagnosis and the countermeasure of the

problem is made more difficult. Such a large-scaled

network needs a management by a skilled person. A

25 network manager (referred simply to as a user) enables

to obtain management data on the network and find out a

problem on the management data or change the management

data and thereby change settings of the system through

the use of network management software.

In general, the network management software allows a user to more clearly view a logical connecting relation of the hosts and handle the hosts through a graphical user interface (GUI). For example, the United States Patent 5,793,974 discloses the display system for managing the network and the method therefor. This publication proposes the method of dividing the hosts into groups (domains) and displaying each group (domain).

A new type of management software has been proposed which manages the storage apparatus in the SAN in the same manner as the host. This type of management software allows a plurality of hosts and storages interconnected with the Fabric Switch or the like to be graphically displayed. However, the function to be handled by this management software is merely to monitor each storage apparatus. For the storage apparatus, the management of a volume is more required rather than the management of the connected apparatuses.

In general, if a storage apparatus is larger in scale than a certain level, the storage apparatus includes a plurality of volumes. Each of the volumes may be accessed by a certain specific host or may be shared by a plurality of hosts belonging to a certain group, or may be commonly accessed by all the hosts in the system. That is, such volumes may be managed in

various forms. Further, as a volume type, there is

provided a block access device that allows an access

from the host at a unit of 512 bytes. Or, in a storage

apparatus called an NAS (Network Attached Storage),

5 each device is allowed to be presented to the host as

one file system.

Recently, the protocol called SCSI over IP

that flows the SCSI protocol onto the LAN is made more

and more standardized. The storage apparatus that has

10 been located only on the Fibre channel may be thus

connected onto the Ethernet that has interconnected the

hosts with each other. It means that the storage

management is likely to be more and more complicated.

The conventional management software that manages only

15 the LAN or SAN cannot cope with the complicated

management of the storages.

SUMMARY OF THE INVENTION

It is an object of the present invention to

provide a method of managing a plurality of storages

20 and volumes in a more fine and more user-understandable

manner in a network environment where the storages and

volumes are interconnected through different physical

communication lines such as the Ethernet and Fibre

Channel.

25 In carrying out the object, the system

according to the invention will be described below.

According to an aspect of the invention, a computer

system is composed of a plurality of hosts, a plurality

of storage subsystems, and a managing subsystem for

managing the plurality of hosts and storage subsystems.

The storage subsystems have their interfaces, re-

spectively. For example, one storage subsystem has an

5   Ethernet interface, one storage subsystem has a Fibre

channel interface, and another storage subsystem has

one or more Ethernet interfaces and Fibre channel

interfaces.

Further, some storage subsystems include a

10   "block access device" to be accessed according to the

block access protocol like iSCSI (Internet SCSI), some

storage subsystems include a "file access device" to be

accessed according to a file access protocol like an

NFS (Network File System), and other storage subsystems

15   include both of the block access device and the file

access device. Each of the hosts are interconnected

with the storage subsystems through the Ethernet or the

Fibre channel. In some connecting form, an Ethernet

switch or a Fibre channel switch may be laid between

20   the host and the storage subsystems.

The management host according to the

invention includes means (view) for graphically

displaying a configuration of a computer system to a

user so that the user can select the display method.

25   As the display methods to be selected by the user are

mainly a physical view and a logical view. The

physical view displays how each host is connected with

the storage subsystems through the Ethernet or the

Fibre channel.   The logical view displays the

connecting relation of the devices included in each

host and each storage subsystem.

The physical view provides a three options of

5   displaying only the host and the storage subsystems

interconnected through the Fibre channel, displaying

the host and the storage subsystems interconnected

through the Ethernet, or displaying both of them.   The

logical view provides a three options of displaying

10   only the block access device, displaying only the file

access device, or displaying both of them.   The

management host is served to collect information about

the apparatuses and the volumes required for the

display from each host, storage subsystem or Fibre

15   channel switch and then to display the view selected on

the collected information by the user.

Further, in general, the device inside of the

storage subsystem connected through the Fibre channel

is a block access device to be accessed from the host

20   according to the Fibre Channel Protocol for SCSI.   If a

certain host is served as a file server and uses the

device and allows an access to another host in an

access protocol such as an NFS, the block access device

is equivalent to a file access device.   In this case,

25   on the logical view, it is preferable that the block

access device is viewed as a file access device to the

user.   In the present invention, the management host

collects the information about the file system of each

host and also allows the device apparently viewed as

the block access device but actually used as the file

access device to be displayed as the file access device

on the logical view.

5   Other objects, features and advantages of the

invention will become apparent from the following

description of the embodiments of the invention taken

in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

10   Fig. 1 is a block diagram showing an

exemplary configuration of a computer system according

to a first embodiment of the present invention;

          Fig. 2 is a block diagram showing a

configuration of a storage subsystem 5c of the computer

15 system according to the first embodiment of the present

invention;

          Fig. 3 is a table showing a content of an FC

storage information 60;

          Fig. 4 is a table showing a content of an IP

20 storage information;

          Fig. 5 is a table showing a content of a

unused device information 100;

          Fig. 6 is a table showing a content of a host

interface management information 80;

25   Fig. 7 is a table showing a content of a file

server management information 90;

          Fig. 8 is a table showing a management

information of an apparatus connected to a Fibre

channel switch 4;

Fig. 9 is a diagram showing an example of a

screen displaying method of a management host 2;

5   Fig. 10 is a flowchart showing a process of

selecting and displaying a view on which a manager 21

accepts a request of a user;

Fig. 11 is a diagram showing a display

example of a physical view for displaying a management

10   host 2 in a computer system according to an embodiment

of the present invention;

Fig. 12 is a flowchart showing a process of

how the manager 21 displays the physical view;

Fig. 13 is a diagram showing a display

15   example of the physical view that the management host 2

displays in a computer system according to an

embodiment of the present invention;

Fig. 14 is a diagram showing a display

example of the physical view that the management host 2

20   displays in a computer system according to an

embodiment of the present invention;

Fig. 15 is a flowchart showing a process of

how the management manger 21 displays a Fibre channel

apparatus;

25   Fig. 16 is a flowchart showing a process of

how the manager 21 displays the logical view;

Fig. 17 is a diagram showing a display

example of the logical view that the management host 2

displays in a computer system according to an

embodiment of the present invention;

Fig. 18 is a diagram showing a display

example of the logical view that the management host 2

5 displays in a computer system according to an

embodiment of the present invention;

Fig. 19 is a diagram showing a display

example of the logical view that the management host 2

displays in a computer system according to an

10 embodiment of the present invention;

Fig. 20 is a diagram showing a display

example of the logical view that the management host 2

displays in a computer system according to an

embodiment of the present invention;

15 Fig. 21 is a flowchart showing how the

manager 21 displays a file access device;

Fig. 22 is a flowchart showing how the

manager 21 displays a block access device; and

Fig. 23 is a flowchart showing how the

20 manager 21 displays a unused device.

DESCRIPTION OF THE EMBODIMENTS

Fig. 1 is a block diagram showing an

exemplary configuration of an embodiment of a computer

system to which the present invention applies. The

25 computer system is configured to have a plurality of

hosts, that is, a host 1a, a host 1b and a host 1c

(collectively called hosts 1), a management host

computer 2, an Ethernet switch 3, a Fibre channel
switch 4, and a plurality of storage subsystems 5a to
5e.

The host 1 includes an Ethernet interface 12
5   (abbreviated as LAN I/F) and a Fibre channel interface
13 (abbreviated as FC I/F). The host 1 makes access to
a plurality of storage subsystems through the Ethernet
switch 3 and the Fibre channel switch 4. Further, the
host 1 includes the software called an agent 11, which
10 is served to communicate with the management host 2.

The management host 2 includes a manager 21
through which the information is transferred with each
agent 11. Like the host 1, the management host in-
cludes a LAN I/F 12 and an FC I/F 13 through which it
15 may access a plurality of storage subsystems. However,
the main roles of the LAN I/F 12 and the FC I/F 13 are
mainly served as a communication port through which the
manager 21 communicates with each agent 11. Further,
the management host 2 includes a display 22 on which
20 the management information of the computer system is
graphically displayed to the user. Though not
illustrated, the management host 2 also includes input
devices such as a keyboard and a mouse for inter-
actively changing the display information through a
25 graphical user interface (GUI).

Each of the storage subsystems 5a, 5b, 5c,
5d, 5e (collectively called a storage 5) includes a
controller 51 and a disk 54. Of the storage 5, the

storage subsystems 5a and 5b include an Ethernet

interface 52, respectively, the storage subsystems 5d

and 5e include a Fibre channel interface 53,

respectively, and the storage subsystem 5c includes

5   both the Ethernet interface 52 and the Fibre channel

interface 53.

Moreover, in this embodiment, each of the

storage subsystems 5a, 5b, 5d, 5e includes a disk 54

and the storage subsystem 5c includes two disks 54. In

10   actual, the storage subsystems may include two or more

disks, respectively. The disk 54 may be a single

magnetic disk drive or an apparent logical disk

composed by combining a plurality of magnetic disks

like a disk array. The controller 51 operates to

15   accept an input/output process from the host 1 or

perform the process or the management of the apparent

logical disk if it is composed by combining a plurality

of physical drives like the disk array.

In this embodiment, the disk 54 to be

20   accessed through the Fibre channel is a device that

follows the Fibre Channel Protocol for SCSI (SCSI

protocol on the Fibre channel), the disk 54 to be

accessed through the Ethernet is a device that follows

the iSCSI (Internet SCSI) protocol or a device that

25   follows a file access protocol such as NFS (Network

File System) or CIFS (Common Internet File System).

The Fibre Channel Protocol for SCSI or the iSCSI

protocol is executed to access data at a fixed-length

block (generally, 512 bytes) unit. In this embodiment,
the disk to be accessed according to the Fibre Channel
Protocol for SCSI or iSCSI protocol is called a block
access device. Further, the NFS/CIFS protocol is
5 executed to manage data at a file unit and has a byte
as a minimum access unit. In this embodiment, the disk
to be accessed according to the NFS/CIFS protocol is
called a block access device or a NAS device.

In succession, the description will be
10 oriented to the configuration of the controller 51
included in the storage 5. In Fig. 2, the components
of the controller 51 are illustrated with the storage
subsystem 5c as an example. The controller 51 is
mainly composed of a processor 511 and a cache memory
15 515. The processor 511 includes an input/output
processing unit 512 for performing an input/output
process like an access to the cache memory 515 or the
disk 54 in response to an input/output request from the
host 1, an apparatus setting unit 513 for performing
20 various settings of the storage subsystem 5c such as
setting of an IP address of the LAN I/F 52, and a
management agent 514 for communicating with the manager
21 of the management host 2. The cache memory 515 is
used for temporarily storing frequently-used data, for
25 making the input/output access from the host faster.
In Fig. 2, the configuration of the controller 51 will
be described with the storage subsystem 5c as an
example. The other storage subsystems 5a, 5b, 5d, 5e

include the input/output processing unit 512, the apparatus setting unit 513, and the management agent 514 as the components, respectively.

Then, the description will be oriented to the information about the apparatus to be collected and managed from each agent 11 of the host 1 and the management agent 514 of the storage 5 by the manager 21 of the management host 2 shown in Fig. 1. The management host 2 collects information from the host 1 and the storage 5 or the Ethernet switch 3 or the Fibre channel switch 4 and is served to display a connecting relation (topology) between the host 1 and the storage 5 based on the collected information.

Figs. 3 and 4 show an apparatus information management table of the storage 5 managed by the management host 2, in which Fig. 3 shows the information of the disk inside of the apparatus connected with the Fibre channel (referred to as FC storage information 60) and Fig. 4 shows the information of the disk inside of the apparatus connected with the Ethernet (referred to as IP storage information 70). The table shown in Fig. 5 manages the information of the disk not to be used by the host 1 (referred to as unused device information 100). The apparatus ID 61 represents a unique identifier to the storage included in the network.

In the tables shown in Figs. 3, 4 and 5, the numeric values of 1, 2, 3,... are assigned as

identifiers.   In actual, however, the identifiers are
not necessarily the numeric values.   If a plurality of
devices (disks) are located inside of the apparatus,
the management host 2 assigns a unique identifier to
5   each device for managing the devices.   This identifier
may be the identifier defined inside of the storage
subsystem 5.   The apparatus ID 61 and the device ID 62
are common to the tables shown in Figs. 3, 4 and 5.
For example, though the information entry of the
10   apparatus ID 61 of "3" exists in the tables shown in
Figs. 3 and 4, it means that the apparatus whose ID 61
is "3" (the storage subsystem 5c in this embodiment)
has both the device connected with the Fibre channel
and the device connected with the Ethernet.

15   A WWN 63 is a unique number in the Fibre
channel interface.   If a storage includes the Fibre
channel interface, and if the device in the storage is
to be accessed by the Fibre channel interface, the WWN
is allocated to each device for managing the devices.
20   A LUN 64 means a logical unit number allocated to each
device and a size 65 means a size of the device.   A
connection permission WWN 66 is used when each device
is set to accept only the access from the host having a
specific WWN.   If the connection permission WWN 66 is
25   specified, it means that only the host having the
specified WWN in the hosts 1 can access the concerned
device.   If a NULL value is specified, it means that
the device with the NULL is permitted to be accessed by

all hosts.

In Fig. 4, a MAC address 73 and an IP address
74 are proper numbers to the Ethernet interface. If a
storage apparatus includes an Ethernet interface and
5 the devices inside of the apparatuses are to be
accessed through the Ethernet interface, the host 1
makes access to the target device with these MAC
address and IP address. If the storage includes a
plurality of Ethernet interfaces and a target device is
10 to be accessed through these interfaces, two or more
addresses are entered into the MAC address 73 and the
IP address 74.

The entry "Export Directory" 75 is used when
the device is accessed as a network file system such as
15 NFS and CIFS. The concerned device is viewed as the
direction with the name specified by the Export
Directory 75 from a viewpoint of a client. The entry
"LUN" 76 is used for the iSCSI device. It is made to
be a NULL value for the device to be accessed by
20 NFS/CIFS. The entry "Size" 77 represents the size of a
device like the entry "Size" 65 shown in Fig. 3. The
entry "Connection Permitted Host" 78 is used in
limiting the host (s) to be accessed from each device.

Fig. 5 shows the unused device information
25 100 that allows the host 1 to manage the information of
a virgin disk. In a case that the storage apparatus is
not a single physical drive but a combination of
magnetic disks as plural logical disks like the disk

array apparatus, it is possible to freely set the

concerned logical disk as any type of device to be

viewed to the host 1.   It is also possible to set the

logical disk so that it is hidden from the host 1.   In

5   this case, since it does not belong to the tables shown

in Figs. 3 and 4, it is managed as the virgin disk.

The apparatus ID 61 and the device ID 102 are the same

identifiers as the device ID 62.   The size 103

represents the size of the virgin disk.

10   In succession, the description will be

oriented to the management information of the host

group inside of the network managed by the management

host 2.   Fig. 6 shows the information about the

Ethernet interface 12 and the Fibre channel interface

15   13 possessed by the host 1, which information is called

the host interface management information 80.   The host

interface management information 80 concerns with the

network information including a host name 81, a WWN 82

of the Fibre channel interface 13 possessed by the host

20   1, a MAC address 83 and an IP address 84 of the

Ethernet interface 12.   In a case that two or more

Fibre channel interfaces 13 or Ethernet interfaces 12

are provided, two or more WWNs or MAC addresses are

registered accordingly.   In a case those interfaces are

25   not provided, the corresponding entries are given NULL.

          Fig. 7 shows a table used if a host operated

as the NFS server or the CIFS server is provided in the

host group inside the network managed by the management

host 2. This table indicates the file server manage-
ment information 90. An entry "host name" 81 is given
a host name where the NFS or CIFS server (daemon
program of the network file system) is operated. The
5   entries "using apparatus" 92 and "device ID" 93 are
given the apparatus ID and the device ID where the file
system permitted by the NFS or CIFS server to be
accessed by another host is provided. The entry
"Export Directory" 94 is a shared directory name, that
10 is, the mount point when the NFS or the CIFS server
make the file system open to the outside.

The table shown in Fig. 8 indicates the
management information of the apparatus connected with
the Fibre channel switch 4. The entry "zone" 111
15 represents the logical units (zone) of two or more
divided switches if the Fibre channel switch 4 is
logically divided into two or more parts by zoning.
Though each zone is given a numeric value of 1 or 2,
any identifier except a numeric value may be used if it
20 is unique. The entry "WWN" 102 indicates the WWN of
the host or the storage apparatus connected to each
zone of the Fibre channel switch 4. In this
embodiment, since only one Fibre channel switch 4 is
provided, just one corresponding table is given. If
25 two or more Fibre channel switches 4 are provided, the
corresponding number of tables are given.

In succession, the description will be
oriented to how the management host 2 provides the

collected information shown in Figs. 3 to 8 to the user

with reference to Figs. 9 or later. The management

host 2 operates to graphically display the management

information of the computer system on a display 22.

5 Fig. 9 shows an example of the screen display 25 of the

computer system according to the embodiment, which is

shown on the display 22 by the management host 2. On

the screen, it is possible to promptly grasp how each

host 1 is connected with the storage apparatus 5 or

10 which of the apparatuses malfunctions. Further, by

selecting the host 1 or the storage apparatus 5 with a

mouse or the like, the apparatus information (including

the IP address of the host 1 or the capacity of the

device inside the storage apparatus) may be displayed.

15   The display form of the screen are roughly

divided into two forms, that is, a physical view

display function that displays a physical connecting

relation of the apparatuses and a logical view display

function that displays the connecting relation between

20 each device (disk) of the storage apparatus 5 and the

host 1. The physical view is mainly useful of means of

grasping the state of each apparatus (normal operation

or malfunction). The logical view is useful of

grasping the capacity and the type of the device that

25 each storage apparatus 5 possesses.

          Fig. 10 is a flowchart showing how the

manager 21 accepts a request of the user, selects the

view, and displays it. The physical view or the

logical view can be freely selected by the user's

instruction to the management host. At first, the

process is executed to accept a request of selecting

which of the physical view and the logical view (step

5   1001). The selecting request given by the user is

realized by accomplishing the selection of a pull-down

menu on the GUI screen. Then, the manager 21

recognizes the user's selection (step 1002). If the

physical view is selected, the physical view display

10 process is executed (step 1003), while the logical view

is selected, the logical view display process is

executed (step 1004). Next, the process of returning

to the step 1001 is repeated for waiting for the user's

request of selecting the view. More detailed processes

15 of the steps 1003 and 1004 will be described later.

The physical view has the following three

ways of display.

(1) Only the apparatuses connected by the

Fibre channel are displayed.

20   (2) Only the apparatuses connected by the

Ethernet are displayed.

(3) The apparatuses of (1) and (2) are

displayed at a time.

In the case of (3), all the apparatuses

25 inside the system are displayed.

Fig. 11 shows an example of the screen of the

physical view displayed by the management host 2

according to the way of display (3) in the system shown

in Fig. 1. In the display example of this embodiment,
the hosts 1a, 1b, 1c, 2 have their host names host A,
host B, host C, host D, which are used on the display
example. The storage subsystems 5a, 5b, 5c, 5d, 5e are
5   displayed as the apparatuses 1, 2, 3, 4, 5 on the
display example. In order to clearly separate the
apparatuses connected by the Fibre channel from the
apparatuses connected by the Ethernet, the connection
by the Ethernet is depicted by a real line, while the
10 connection by the Fibre channel is depicted by a dotted
line. In place, these connections may be separated in
respective colors.

In a case that the number of the apparatuses
configured on the system is relatively small as shown
15 in Fig. 1, the way of display (3) is practical, while
if the number of the configured apparatuses is greater,
it is difficult to refer to all the apparatuses on one
screen. In particular, difficulty is focused on that
the communication lines of connecting the host 1 with
20 the storage apparatus 5 are made complicated on the
display screen. In order to overcome this difficulty,
the present invention has a function of displaying only
the apparatuses connected with the Fibre channel and
the Ethernet like the ways of display (1) and (2).

25   The flow of the physical view display process
will be described with reference to Fig. 12. The
process is executed to determine if the user requests
to display the Fibre channel connected apparatuses

(step 1101). If yes, in step 1102, the process is
executed to display the Fibre channel connected
apparatuses. If no, the process goes to a step 1103,
in which it is determined if the user requests to
5   display the Ethernet connected apparatuses. If yes,
the process is executed to display the Ethernet
connected apparatuses (step 1104).

Fig. 13 shows the screen on which only the
apparatuses connected by the Ethernet are displayed on
10 the system configuration shown in Fig. 1. Fig. 14
shows the screen on which only the apparatuses
connected by the Fibre channel are displayed on the
system configuration shown in Fig. 1. If a zoning is
set so that one switch is logically divided into two or
15 more switches in the Fibre channel environment, as
shown in Fig. 14, the separated connection is
displayed. Since it is shown in the separated form,
the number of the apparatuses displayed on the screen
is made smaller. Hence, the connection shown in the
20 separated form is effective in the case the number of
the apparatuses to be managed is larger.

Fig. 15 shows the flow of the process of
displaying the apparatuses connected by the Fibre
channel in step 1102. At first, the process is
25 executed to obtain the management information of the
apparatus connected with the Fibre channel switch 4 as
shown in Fig. 8 (which management information is
referred to as FC apparatus management information)

(step 11021). This information may be periodically obtained from the Fibre channel switch 4 by the manager 21. In this case, the process of the step 11021 may be removed.

5   In succession, the process is executed to check the states of the host 1 and the storage apparatus 5 having the WWN in the FC apparatus management information, selected from the informations of the storage apparatus 5 and the host 1 shown in Figs. 3 and

10   6 (step 11022). This process is executed to check the state of the apparatus as the manager 21 is communicating with the agent 11 or the management agent 514. In step 11023, the process is executed to provide the display according to the state of each apparatus from

15   the informations obtained in steps 11021 and 11022. Concretely, if the zoning is set, as shown in Fig. 14, the Fibre channel switch 4 is divided into two or more when it is displayed. Or, if a certain apparatus malfunctions, it is displayed in red.

20   The display of the logical view will be described with reference to Figs. 16 or later. The logical view shows the connecting relation between each disk 54 of the storage apparatus 5 and the host 1. As stated above, the disk 54 according to this embodiment

25   is roughly divided into two types, that is, the block access device and the file access device. In case of large storage system, a plurality of magnetic disks may be divided into several groups, some of which are

defined as the block access device and the other of

which are defined as the file access device. That is,

the type of the device may be dynamically changed.

Further, any unused device that does not belong to both

5 of the types may be provided in the system.

Hence, the logical view provides the follow-

ing four ways of display.

(1) Only the block access device or file

access device is displayed

10   (2) All the devices are displayed.

(3) Only the unused devices are displayed.

(4) The connecting relation between the host

computer and the disk is displayed when an access

limitation is placed on the host computer.

15   In general, the block access device is used

when accessing at a fast speed the data dedicated for a

specific system and software, such as a database. The

file access device is used when a plurality of host

computers share a file. Which of the types is to be

20 selected is irrespective of the interface like the

Fibre channel or the Ethernet. It is selected by the

user in consideration of the data to be stored and the

purpose of use. Hence, independently of the interface

through which the storage apparatus is connected, it is

25 preferable that the logical view enables to separate

the storage apparatuses into the block access device

and the file access device when they are displayed.

However, the block access device may be the Fibre

channel connected device through the use of the Fibre

Channel Protocol for SCSI or the Ethernet connected

device through the use of the iSCSI to be transferred

on the Ethernet. Hence, the devices according to the

5   iSCSI protocol are separated from those according to

the Fibre Channel Protocol for SCSI when the connecting

relation among the devices is displayed.

The flow of the process of displaying the

logical view will be described with reference to Fig.

10   16. At first, it is determined if the user requests to

display the file access device (step 1201). If yes,

the process is executed to display the file access

device in step 1202, while if no, the process goes to a

step 1203. In step 1203, it is determined if the user

15   requests to display the block access device. If yes,

the process is executed to display the block access

device (step 1204). In step 1205, it is determined if

the user requests to display the unused device. If

yes, the process of displaying the unused device is

20   executed in step 1206.

Fig. 17 shows the screen where the logical

view is displayed according to the way of display (2)

by the management host 2 in the system configured as

shown in Fig. 1, that is, all the devices displayed on

25   the screen. However, no unused device is provided in

this example. In this example, the block access

devices are mingled with the devices according to iSCSI

protocol and the devices according to the Fibre Channel

Protocol for SCSI. On the screen, hence, the device

according to the iSCSI protocol is connected with the

host 1 in alternate long and short dash lines, the

devices according to the Fibre Channel Protocol for

5 SCSI are connected with the host 1 in dotted lines, and

the file access devices are connected with the host 1

in real lines. Another way of display may be used like

coloring.

Fig. 18 shows an example of a screen where

10 only the file access devices are displayed according to

the way of display (1) when the devices whose apparatus

ID 61 are "2" and "3" are the file access devices as

shown in the management table of Fig. 4. In order to

display only the file access device or the block access

15 device, the management host 2 operates to refer to the

management table of Fig. 4, extract only the file

access device or the block access device, and display

it on the screen.

As shown in Fig. 7, another form may be

20 provided where a certain host (in which case it is the

host C, that is, the host 1c on the configuration shown

in Fig. 1) is served as a server of the NFS/CIFS to

provide another host 1 with the file system device. In

this example, the host 1c provides as the device of

25 NFS/CIFS the disk whose apparatus ID is "4" (that is,

the storage subsystem 5d in Fig. 1) and the device ID

is "0". In this case, hence, the management host 2

operates to display the storage subsystem 5d as the

file access device as shown in Fig. 19. By this operation, the number of erroneous operations is reduced. The erroneous operation is, for example, that the block device that has been used as the file access

5 device may be erroneously selected.

In this embodiment, as shown in Figs. 4 and 7, the host computer that permits connection of each device has been decided. The management host 2 enables to display the connecting relation between the devices

10 and the host computer in consideration of the access limitation of each device.

Fig. 20 shows the screen appearing when only the file access device is displayed in consideration of the connection permitted hosts 78 and 95 shown in Figs.

15 4 and 7. On this screen, it is possible to more clearly grasp the connecting relation between the host computer and each device at the current time. In the example of Fig. 19, the connecting relation between the storage subsystem 5d and the hosts 1a, 1c and 1d is

20 viewed to be formed. As is understood from Fig. 20, in actual, it is obvious that the host 1c cannot access the storage apparatus (in particular, of the file access device).

Then, the description will be oriented to the

25 flow of the process of displaying the file access device while the logical view is being displayed (corresponding to the step 1202 of Fig. 16) with reference to Fig. 21. At first, the process is

executed to extract the entry where the Export

Directory 75 is specified of the IP storage information

70, that is, the file access device (step 12021).

Next, the process is executed to pick up the infor-

5   mation of the device used for the file access device

from the file server management information 90 shown in

Fig. 7 (step 12022). This allows even the device

connected with the Fibre channel interface as a

physical interface to specify the device being actually

10   used as the file access device.

In step 12023, the process is executed to ask

the storage apparatus to which each device extracted in

the steps 12021 and 12022 belongs of the state of each

device. In step 12024, then, the state of each host is

15   inquired. In step 12025, the file access device is

displayed, and in step 12026 the hosts (only the hosts

that do not operate as the file server) are displayed.

In succession, it is determined if the user requests to

display the apparatuses in consideration of the access

20   limitation (step 12027). If the request for the

display is issued, the process goes to a step 12028, in

which each device is interconnected with only the

connection permitted hosts by lines by referring to the

information of the connection permitted hosts when the

25   state is displayed. If no request is issued, all the

hosts are interconnected with all the file access

devices by lines on the display (step 12029).

In turn, the description will be oriented to

the flow of the process of displaying the block access
device while the logical view is being displayed
(corresponding to the step 1204 of Fig. 16) with
reference to Fig. 22. At first, the process is
5   executed to pick up only the devices connected with the
Fibre channel but being used for the file access device
by referring to the FC storage information 60 of Fig. 3
and the file server management information 90 of Fig. 7
(step 12041). Next, the process is executed to pick up
10 the information of the devices in which no Export
Directory 75 is specified in the IP storage information
70 of Fig. 4 (that is, the iSCSI access device) and
that are not used for the file access device in the
file server management information 90 of Fig. 7 (step
15 12042). This allows even the device apparently viewed
as the block access device to exclude the device that
is actually used for the file access device.

In step 12043, the process is executed to ask
the storage apparatus to which each device extracted in
20 the steps 12041 and 12042 belongs of the state of each
device. Next, in step 12044, the state of each host is
inquired. In step 12045, the block access device is
displayed, and in step 12046, the state of the host is
displayed.

25 In succession, it is determined if the user
requests the display in consideration of the access
limitation from the connection permitted WWN 66 and the
connection permitted host 78 included in the FC storage

information 60 of Fig. 3 and the IP storage information

70 of Fig. 4 (step 12047). If the request is issued,

the process goes to a step 12048, in which each device

is connected with only the connection permitted hosts

5 by lines by referring to the information of the

connection permitted hosts. If no request is issued,

all the hosts are connected with all the block access

devices by lines on the screen display (step 12049).

Fig. 23 is a flowchart of the process of

10 displaying a unused device (corresponding to the step

1206 of Fig. 16) with reference to Fig. 23. In step

12061, the unused device information 100 of Fig. 5 is

retrieved. In succession, the process is executed to

ask the storage apparatus to which the retrieved device

15 belongs of the state of the device (step 12062).

Lastly, the unused device is displayed on screen (step

12063), and then the process is terminated. For the

unused device, the device is not still connected with

the host 1, so that the line connection between the

20 device and the host 1 is not displayed on screen.

According to the foregoing embodiment, the

topology display method that is more visually grasped

by the user is provided in the environment where the

hosts and the storage apparatuses are interconnected

25 through a plurality of interfaces such as the Ethernet

and the Fibre channel. Further, the block access

device is separated from the file access device when

the connecting form is displayed. Hence, the user can

more easily manage the block access device connected

with the Fibre channel but being used for the file

access device, often included in the file server.

The management method of the present

5 invention makes it easier to grasp the management of

the apparatus by displaying the apparatus of a specific

interface in the environment where a plurality of

interfaces are mingled. Further, the disk capacity

management according to each way of purpose is made

10 possible by displaying only the information of a

specific device selected from several types of devices.

It should be further understood by those

skilled in the art that the foregoing description has

been made on embodiments of the invention and that

15 various changes and modifications may be made in the

invention without departing from the spirit of the

invention and the scope of the appended claims.